

Application No.: 10/023267

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Remarks

Claims 1 to 22 are pending in this application. Claims 17 to 22 have been withdrawn from consideration. Claims 1-16 have been rejected. By this Response, claims 1, 5, 7, 8, and 16 are amended, and claims 2 and 6 are canceled. Applicants respectfully request reconsideration of the rejected claims in light of the amendments and the following remarks.

Claim Amendments

The claims have been amended to further clarify and define the invention. Support for the amendments is found throughout the application. No new matter is added by these amendments.

§ 112 Rejections***Indefiniteness***

Claims 1 to 16 stand rejected under 35 USC § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regard as the invention. Applicants respectfully submit that the above claim amendments overcome this rejection.

With respect to claim 1, the Examiner asserts that it is not clear what is meant by the word "improved." Specifically, the Examiner states that it is not clear whether either increasing or decreasing hydrophilicity could be considered an improvement. Applicants point out that on page 22 and in Table 5, the present specification specifies how the bulk wetting properties are improved by showing that treatment causes a decrease in contact angle and an increase in water flow, both of which are indicative of an increase in hydrophilicity. For the sake of clarity, Applicants have amended claim 1 to recite that the hydrophilicity of the article is increased by the treatment. The § 112 rejection of this claim may now be withdrawn.

With respect to claims 3 and 14, the Examiner asserts that the term "treatment" is not clearly related to any limitation of the independent claim. Applicants have amended claim 1 to clarify that the step of "allowing reactive species from the plasma to react with the article surface and pore interiors" is the "treatment" that is referred to in claims 3 and 14. Applicants

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respectfully submit that the § 112 rejection of these claims has been overcome and may now be withdrawn.

The Examiner states for the record that the phrase "the plasma comprises silicon" in claim 4 is considered to read on the plasma containing either Si vapor or a Si-containing gas. Applicants acknowledge and confirm this reading of the claims.

With respect to claims 5, the Examiner states that it is unclear how the limitation "the ion sheath proximate the powered electrode" necessarily further limits the independent claim. In particular, the Examiner contends that the term "proximate" is a relative description of location that could include either near or in the ion sheath, and thus an ion sheath formed around one electrode may be considered "proximate" to both of them. In order to eliminate the potential ambiguity identified by the Examiner, Applicants have amended claim 5 to recite that the ion sheath is "formed around" the powered electrode. Since the base claim (i.e., claim 1) states that the ion sheath may be formed around either of the electrodes (i.e., either the powered electrode or the grounded electrode), by specifying in claim 5 that the ion sheath is formed around the powered electrode, this claim is now clearly narrower in scope than the base claim. The § 112 rejection of claim 5 may now be withdrawn.

With respect to claims 7 and 8, the Examiner asserts that it is unclear how the shadow mask relates the process recited in claim 1, and at what point in time is it used. Applicants have amended these claims to specify that the shadow mask is placed between (i.e., near or on) the article and the plasma during treatment. Further details for the use of the shadow mask are provided in Example 8 on pages 23-24 of the present specification. Applicants respectfully submit that, in view of the amendment, the § 112 rejection of claims 7 and 8 may now be withdrawn.

With respect to claim 16, the Examiner asserts that the term "diamond-like glass" does not have a defined meaning in the art and thus is unclear. Specifically, the Examiner states that since diamonds are crystalline and made of carbon, not Si, whereas glass is a Si-containing amorphous material, it is unclear how a glass film can in any way be defined as "diamond-like." The term "diamond-like" simply means that the material has some properties in common with diamonds, but not all the properties are the same. The Examiner is correct that diamonds are crystalline whereas diamond-like glass (DLG) is amorphous; however, despite these distinctions,

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DLG does have some similarities to diamonds. For example, DLGs exhibit Sp^3 bonding, have similar optical properties to diamonds, and are densely packed. On page 11, the present specification identifies a copending patent application, USSN 09/519,449, which describes DLG and its properties in more detail. Thus, Applicants respectfully submit that the present specification provides sufficient guidance so that one skilled in the art would clearly understand the meaning of this term.

Lack of enablement

Claim 16 is rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. The Examiner asserts that there is no clear enablement for determining "what 'diamond-like glass' is, or how to recognize a film with its properties, or what its properties are." (Office Action, p. 4). Applicants respectfully traverse this rejection.

As discussed above, the present specification identifies, on page 11, line 12, a copending U.S. patent application that provides the full details regarding diamond-like glass and its properties. This application has since issued as U.S. Patent No. 6, 696,157. Since these teachings regarding diamond-like glass are provided in another U.S. Patent referenced in the present application, those details need not be repeated again in this specification. For these reasons, Applicants respectfully submit that claim 16 is fully enablement and the § 112 rejection of this claim should be withdrawn.

§ 103 Rejections

Gardella et al. in view of David et al.

Claims 1-3, 5-7, and 9-14 stand rejected under 35 USC § 103(a) as being unpatentable over Gardella, Jr. et al. (U.S. Patent No. 4,946,903) in view of David et al (U.S. Patent No. 5,948,166). Applicants respectfully traverse this rejection as applied to the amended version of the claims.

In order to establish a *prima facie* case of obviousness, the Patent Office must demonstrate that (1) there is a suggestion or motivation in the prior art to modify or combine reference teachings, (2) one skilled in the art would have had a reasonable expectation of success in making the modification or combination, and (3) the prior art reference(s) disclose all of the claim limitations. The fact that one of ordinary skill in the art would have had the capability to modify the

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method disclosed in the prior art reference(s) is not sufficient. MPEP 2143.01. The prior art reference(s) must provide a motivation or reason for making the changes. MPEP 2142; *Ex parte Chicago Rawhide Manufacturing Co.*, 226 USPQ 438 (PTO Bd. App. 1984).

The Examiner states that Gardella teaches "RF glow discharge plasma to modify porous fluoropolymer substrates to increase wettability and/or adhesiveness." Although the Examiner acknowledges that Gardella fails to "provide any details of the apparatus used as claimed," the Examiner relies on David to compensate for the deficiencies of Gardella. According to the Examiner, David describes "an RF plasma apparatus taught to be useful for treating sheets of porous, temperature sensitive polymer material and for substrates used as orthopedic implants, packaging materials, etc." The Examiner thus reaches the conclusion that "It would have been obvious to one of ordinary skill in the art, to employ the apparatus of David et al in the process of Gardella et al, as it is suggested for use on the types of substrates being treated by the primary references, with the advantage of solving deficiencies in both processing and alternative hollow cathode type plasma apparatus." (Office Action, p. 5-6). Applicants respectfully disagree.

The Patent Office has failed to establish that one skilled in the art would have had a reasonable expectation of success in making the combination asserted by the Examiner. MPEP 2143.01. As explained on page 4 of the present specification, in plasma-treating a porous article, if the pore size is smaller than the mean free path of the species in the plasma, normally the free radical species generated in the plasma will collide with the pore walls near the pore opening. Thus, the free radicals will react with molecules in the pore walls near the pore opening rather than traveling into the depths of the pores. Consequently, one skilled in the art would not have expected the plasma treatment to penetrate into the depths of the pores, especially when the pores have tortuous paths.

Applicants have described and demonstrated for the first time that the ion sheath, an area around an electrode in which ion bombardment is prevalent, can force chemical species from the plasma into small pores of the articles being treated with the plasma. This results in a change in the hydrophilicity of the pore interiors, which in turn modifies the bulk wetting properties of the article. At the time the present invention was made, a skilled artisan would not have expected that plasma treatment could be achieved within small pores having tortuous paths where the pore

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sizes are smaller than the mean free path of the species in the plasma because the species would have been expected to collide with the pore walls near the opening of the pore.

Nothing in Gardella or David provides an expectation of success in plasma treating an article having pores that are smaller than the mean free path of any species in the plasma, nor do these references teach or suggest that the ion sheath provides a means for accomplishing penetration of the plasma species into the depths of the pores. For these reasons, Applicants respectfully submit that the present claimed invention is patentable over the combination Gardella and David. This rejection should, therefore, be withdrawn.

Gsell view of David et al.

Claims 1-7 and 9-14 stand rejected under 35 USC § 103(a) as being unpatentable over Gsell (U.S. Patent No. 5,679,264) in view of David et al. (U.S. Patent No. 5,948,166).

Applicants respectfully traverse this rejection as applied to the amended version of the claims.

The Examiner states that Gsell teaches "gas plasma treatment of porous media." Although the Examiner acknowledges that "no specific plasma apparatus is discussed in detail" by Gsell, and that "Gsell lacks teachings of any specific electrode structure and ion sheaths," the Examiner relies David to compensate for the deficiencies of Gsell. According to the Examiner, David describes "an RF Plasma apparatus, suitable for treating substrates as taught in Gsell" and thus asserts that "use of David et al's apparatus for the process of Gsell would have been obvious due to the suggested use in David et al." (Office Action, p. 7). However, the Examiner has not established that one skilled in the art would have had a reasonable expectation of success in making this combination. As described on page 4 of the present application, for most gases, including those used in the present invention and in the apparatus described by David et al., the mean free path of the atoms is generally on the order of several millimeters when at pressures which are useful for plasma treatment. In contrast, the pore sizes of the porous materials described by Gsell are much smaller on average. In particular, Gsell teaches that "generally, the pore diameter of the porous medium in accordance with the invention may be in the range of from about 0.5 μm to about 50 μm , preferably about 2 to 10 μm " (Col. 7, lines 1-3). Given that the pore size of the materials described by Gsell are much smaller than the mean free path of the species in the plasma described by David, in combining the apparatus of David with the

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process of Gsell, one skilled in the art would have not have expected the interior regions of the article to be penetrated.

As amended, independent claim 1 specifically recites that the article pores are "smaller than the mean free path of any species in the plasma." The fact that in the presence of ion bombardment in the sheath the plasma is able to attain deeper penetration of porous materials was a surprising and unexpected result that was described and demonstrated for the first time in the present application. Since nothing in Gsell or David provides any expectation of success in their combination – to the contrary one skilled in the art would have expected that the plasma treatment would not have penetrated deeply into the porous material – and since neither of these references discloses the deeper penetration that can be achieved in the ion sheath, the combination of these references fails to render the presently claimed invention obvious. The § 103 rejection over Gsell in view of David et al. should, therefore, be withdrawn.

Sayers in view of David et al.

Claims 1-7 and 9-14 stand rejected under 35 USC § 103(a) as being unpatentable over Sayers (WO 99/05358) in view of David et al. Applicants respectfully traverse this rejection as applied to the amended version of the claims.

The arguments presented by the Examiner in connection with Sayers are analogous to those provided in connection with the Gsell reference described above. The Examiner states that "Sayers teaches continuous plasma treating one or both sides of woven or non woven lengths of material for fabrics under in conveyor belts or filter cloths, etc." (Office Action, p. 8). As with Gsell, Sayers fails to provide any details regarding the plasma apparatus and so the Examiner again relies on David to compensate for the deficiencies of the primary reference. However, as explained in detail above, one skilled in the art would not have had an expectation of success in plasma treating the Sayer materials because there would not have been an expectation that the chemical species of the plasma would penetrate deeply into the small pores of the article. Applicants' discovery that the ion bombardment in the ion sheath enables the plasma to achieve deeper penetration of porous materials was surprising, unexpected, and not described anywhere in the cited references. For this reason, Applicants respectfully submit that the present invention is patentable over the cited references.

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Gsell or Sayers in view of David et al., further in view of Lee et al.

Claims 14 - 16 stand rejected under 35 USC § 103(a) as being unpatentable over Sayers or Gsell, in view of David et al. as applied to claim 1-7 and 9-14, and further view of Lee et al. (WO 00/16913). The Examiner asserts that Lee disclosed the additional limitations recited in dependent claims 14 - 16 that are not disclosed in the primary references. Since, for the reasons discussed in detail above, independent claim 1 is patentable over these references, claims 14 - 16, all of which depend directly or indirectly from claim 1, are likewise patentable for the same reasons previously discussed. The § 103 rejection of these claims should, therefore, be withdrawn.

Gardella, Sayers, or Gsell in view of David et al., further in view of Roller et al. or Everhart et al.

Claim 8 stands rejected under 35 USC § 103(a) as being unpatentable over Gardella Jr. et al. or Gsell or Sayers in view of David et al. as applied to claims 1-7 and 9-14, and further in view of Roller et al. (U.S. Patent No. 5,980,814) or Everhart et al. (U.S. Patent No. 5,494,744). The Examiner asserts that Roller et al. and/or Everhart et al. disclose the additional limitation recited in dependent claim 8 that is not disclosed in the primary references. Since, for the reasons discussed in detail above, independent claim 1 is patentable over these references, claim 8, which depends directly or indirectly from claim 1, is likewise patentable for the same reasons previously discussed. The § 103 rejection of this claim should, therefore, be withdrawn.

Double Patenting Rejection

Claim 1 has been provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 10/293,830. Since this is a provisional application, Applicants will address the merits of the rejection once there is an allowed claim in either application.

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Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Reconsideration of the application is requested.

All communications in this case should be direct to the undersigned. If the Examiner believes a telephone discussion would be helpful to resolve any of the outstanding issue in this case, the Examiner is encouraged to call the undersigned at the number listed below.

Respectfully submitted,

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